Chapter 1
Introduction

1-1. Purpose

The purpose of this manual is to provide guidance for the safe design and economical construction of sheet pile retaining walls and floodwalls. This manual does not prohibit the use of other methods of analysis that maintain the same degree of safety and economy as structures designed by the methods outlined herein.

1-2. Applicability

This manual applies to all HQUSACE elements, major subordinate commands, districts, laboratories, and field operating activities (FOA) having civil works responsibilities.

1-3. References, Bibliographical and Related Material

a. References pertaining to this manual are listed in Appendix A. Additional reference materials pertaining to the subject matter addressed in this manual are also included in Appendix A.

b. Several computer programs are available to assist in applying some of the analytical functions described in this manual.

(1) CWALSHT - Performs many of the classical design and analysis techniques for determining required depth of penetration and/or factor of safety and includes application of Rowe's Moment Reduction for anchored walls. (CORPS Program X0031)

(2) CWALSSI - Performs soil-structure interaction analysis of cantilever or anchored walls (Dawkins 1992).

1-4. Scope

Design guidance provided herein is intended to apply to wall/soil systems of traditional heights and configurations in an essentially static loading environment. Where a system is likely to be required to withstand the effects of an earthquake as a part of its design function, the design should follow the processes and conform to the requirements of "A Manual for Seismic Design of Waterfront Retaining Structures" (U.S. Army Engineer Waterways Experiment Station (USAEWES) in preparation).

1-5. Definitions

The following terms and definitions are used herein.

a. Sheet pile wall: A row of interlocking, vertical pile segments driven to form an essentially straight wall whose plan dimension is sufficiently large that its behavior may be based on a typical unit (usually 1 foot) vertical slice.

b. Cantilever wall: A sheet pile wall which derives its support solely through interaction with the surrounding soil.

c. Anchored wall: A sheet pile wall which derives its support from a combination of interaction with the surrounding soil and one (or more) mechanical devices which inhibit motion at an isolated point(s). The design procedures described in this manual are limited to a single level of anchorage.

d. Retaining wall: A sheet pile wall (cantilever or anchored) which sustains a difference in soil surface elevation from one side to the other. The change in soil surface elevations may be produced by excavation, dredging, backfilling, or a combination.

e. Floodwall: A cantilevered sheet pile wall whose primary function is to sustain a difference in water elevation from one side to the other. In concept, a floodwall is the same as a cantilevered retaining wall. A sheet pile wall may be a floodwall in one loading condition and a retaining wall in another.

f. I-wall: A special case of a cantilevered wall consisting of sheet piling in the embedded depth and a monolithic concrete wall in the exposed height.

g. Dredge side: A generic term referring to the side of a retaining wall with the lower soil surface elevation or to the side of a floodwall with the lower water elevation.

h. Retained side: A generic term referring to the side of a retaining wall with the higher soil surface elevation or to the side of a floodwall with the higher water elevation.

i. Dredge line: A generic term applied to the soil surface on the dredge side of a retaining or floodwall.

j. Wall height: The length of the sheet piling above the dredge line.

k. Backfill: A generic term applied to the material on the retained side of the wall.

l. Foundation: A generic term applied to the soil on either side of the wall below the elevation of the dredge line.

m. Anchorage: A mechanical assemblage consisting of wales, tie rods, and anchors which supplement soil support for an anchored wall.

(1) Single anchored wall: Anchors are attached to the wall at only one elevation.

(2) Multiple anchored wall: Anchors are attached to the wall at more than one elevation.

n. Anchor force: The reaction force (usually expressed per foot of wall) which the anchor must provide to the wall.

o. Anchor: A device or structure which, by interacting with the soil or rock, generates the required anchor force.

p. Tie rods: Parallel bars or tendons which transfer the anchor force from the anchor to the wales.

q. Wales: Horizontal beam(s) attached to the wall to transfer the anchor force from the tie rods to the sheet piling.

r. Passive pressure: The limiting pressure between the wall and soil produced when the relative wall/soil motion tends to compress the soil horizontally.

s. Active pressure: The limiting pressure between the wall and soil produced when the relative wall/soil motion tends to allow the soil to expand horizontally.

t. At-rest pressure: The horizontal in situ earth pressure when no horizontal deformation of the soil occurs.

u. Penetration: The depth to which the sheet piling is driven below the dredge line.

v. Classical design procedures: A process for evaluating the soil pressures, required penetration, and design forces for cantilever or single anchored walls assuming limiting states in the wall/soil system.

w. Factor of safety:

(1) Factor of safety for rotational failure of the entire wall/soil system (mass overturning) is the ratio of available resisting effort to driving effort.

(2) Factor of safety (strength reduction factor) applied to soil strength parameters for assessing limiting soil pressures in Classical Design Procedures.

(3) Structural material factor of safety is the ratio of limiting stress (usually yield stress) for the material to the calculated stress.

x. Soil-structure interaction: A process for analyzing wall/soil systems in which compatibility of soil pressures and structural displacements are enforced.